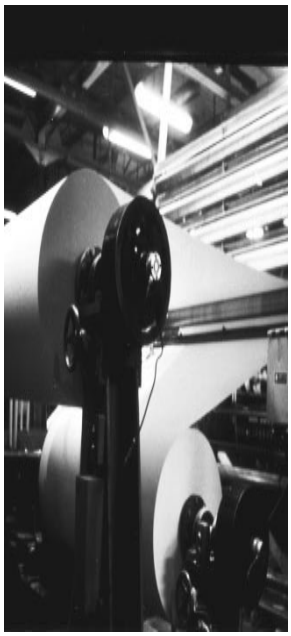
ALLEN-BRADLEY

Integrating Allen-Bradley Products on an Ethernet TCP/IP Network

System Overview



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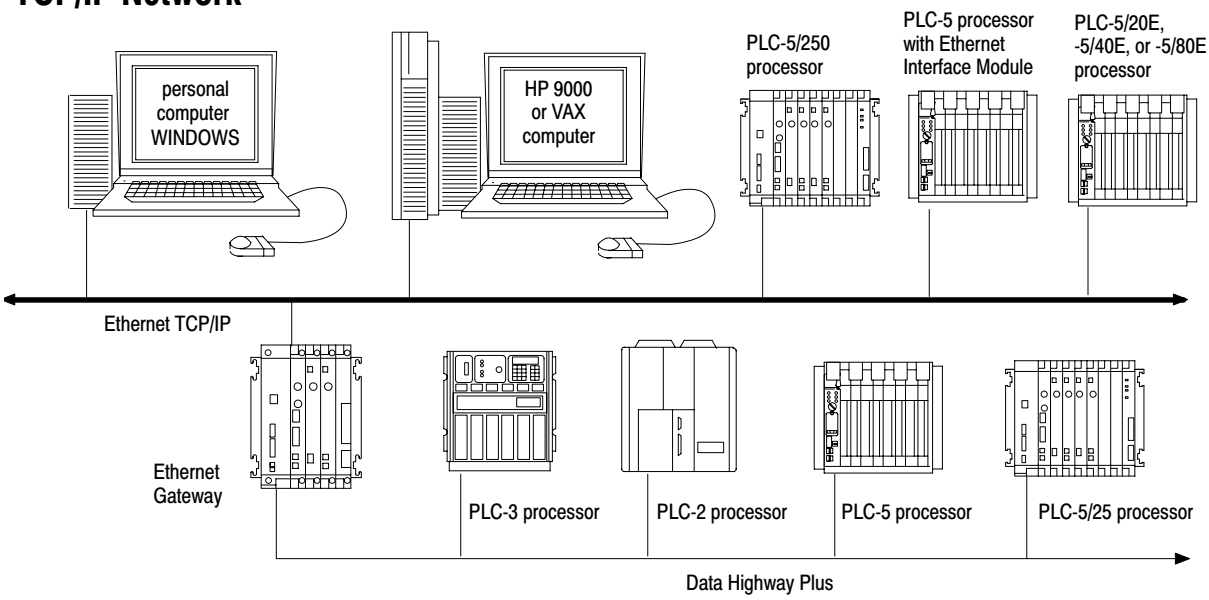
Using this Book

Introducing the Ethernet TCP/IP Network



Ethernet is a local area network with a baseband communication rate of 10M bit/s designed for the high-speed exchange of information between computers and related devices.

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Networking Fundamentals

Overview

This chapter acquaints you with the fundamental parts of an Ethernet network, which include:

- cabling issues
- protocol
- network components

This chapter also describes the ISO/OSI reference model and explains each of its seven layers.

Cabling Issues

On the most basic level, Ethernet is a wire or cable that connects computers and peripheral devices so that they can communicate. The actual wire used for a network is called the network medium.

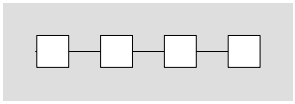
In this section, we look at three aspects of Ethernet, expanding as we go: the cable for the simplest of networks, the topology of slightly more complex networks, and, finally, the extension and interconnection of larger networks.

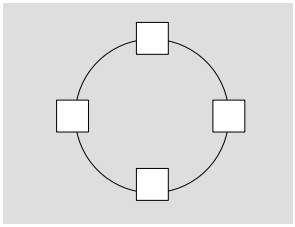
Simple Networks

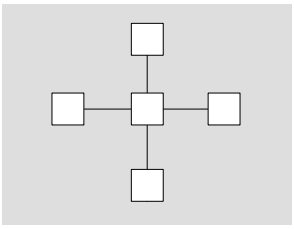
Ethernet has three basic media types: thickwire coax, thinwire coax, and twisted pair. These media are also referred to by their IEEE designations, 10base5, 10base2, and 10baseT respectively.

- 10base5 – 500m segment, 100 nodes, 2.5m minimum between nodes (requires 50 ohm terminators, and single-point ground)
- 10base2 – 200m segment, 30 nodes, 0.5m minimum between nodes (requires 50 ohm terminators, uses BNC connectors)
- 10baseT (twisted-pair hub), 1 node per 100 meters

Products are also available to extend Ethernet networks with optical fiber and other physical media such as satellite links and broadband.







Network Topology

The topology of a network is simply how you arrange your computers and devices on the wire, and how they pass their information. Common topologies include:

- *bus* – single line shared by a number of nodes

  Ethernet thickwire and thinwire media use a bus topology.
- *ring* – unbroken circular configuration, where each node is an active repeater
- *star* (radial) – all nodes are joined at a single point (and may be controlled by that central node)

  An Ethernet twisted-pair configuration uses a star topology with a hub as the central node. Its logical configuration is that of a bus.

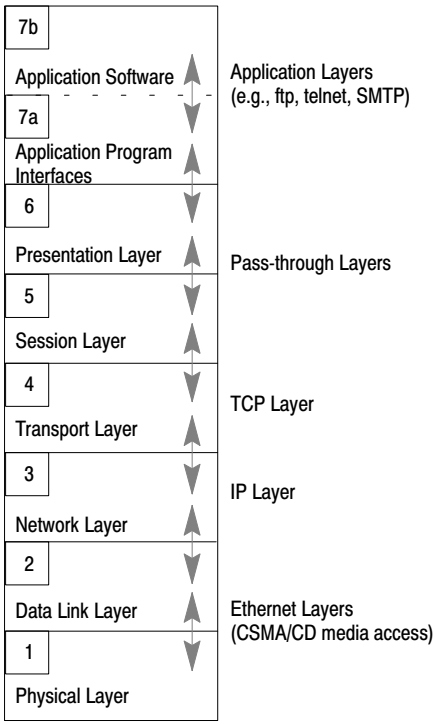
Extending and Interconnecting LANs

To extend a simple local area network (LAN) to one that is more complex and far-reaching, you can use these communication devices:

- *repeater* – extends cable distance limits by connecting two segments of LAN cable.
- *bridge* – isolates traffic between networks by filtering MAC addresses (low-level Ethernet hardware addresses) while performing the same connecting function as a repeater.
- *router* – connects two or more networks of the same type, and selectively directs and filters packets pertaining to the protocol used on the wire. For example, a TCP/IP router directs and filters IP addresses.
- *gateway* – connects two or more networks of different types, and translates different protocols.

There are limits as to how far you can extend an Ethernet network with these devices. There is a maximum of two repeaters allowed in a network. For the other devices (bridge, router, and gateway), the number of possibilities is too great to address here. See page 1–8 for sources of additional information.

Interpreting the ISO/OSI Reference Model



The International Standards Organization (ISO) developed a networking model called Open Systems Interconnect (OSI) to provide a common framework around which to build new protocol standards. The figure shows how the Transmission Control Protocol/Internet Protocol (TCP/IP) on an Ethernet network fits this model. Each layer of the model uses the services of the layers below it.

Ethernet Layers

The physical layer (1) and the data link layer (2) make up the Ethernet layer. This is the physical wire and the access method to use the wire.

TCP/IP Layers

The IP or network layer (3) handles routing and conversion of data between two networked entities; the TCP or transport layer (4) handles data integrity, the error-free transmission of packets of information. TCP splits the packets into acceptable sizes for transport and puts them back together again when they arrive at their destination.

Pass-through Layers

The session layer (5) and the presentation layer (6) are called the pass-through layers in that they are not specifically implemented in a TCP/IP network.

Application Layers

The seventh layer of the ISO/OSI reference model is the application layer, which includes the application programming interface (7a) and the application software (7b). This layer controls functions such as file transfer (ftp), terminal emulation (telnet), and electronic mail (SMTP). It provides the user interface and application programming interface (API) to network applications.

Allen-Bradley application programming interfaces (API) include INTERCHANGE™ software and RSLinx software. See chapter 2 for information about applications and application software.

Protocol

A protocol consists of the messages exchanged between services in the same layer and the rules governing these message exchanges.

Medium Access Control (MAC)

Access control determines ‘who talks when’. The data link layer, layer 2 of the ISO/OSI reference model, handles access control.

Ethernet uses Carrier Sense Multiple Access with Collision Detection (CSMA/CD) as its access method. Devices on the Ethernet network can sense when the channel is busy and can hold their transmissions until the channel is available. These devices can monitor the channel while transmitting to determine if any other stations are attempting to transmit. Because of the delay on the wire, two or more stations may sense an available channel and attempt to transmit simultaneously. This results in a collision. After a collision, each node waits a random period of time before transmitting again.

Understanding TCP/IP

Transmission Control Protocol/Internet Protocol (TCP/IP) is a transport-layer protocol (TCP) and a network-layer protocol (IP) commonly used for communication within networks and across internetworks.

TCP/IP is the Allen-Bradley protocol of choice for Ethernet communication. Alternative protocols include:

- DECnet® (Digital Equipment Corporation proprietary network)
- OSI/MAP (Open Systems Interconnection / Manufacturing Automation Protocol)
- XNS (Xerox® Network Systems)

About BOOTP

BOOTP is a low-level protocol that provides configurations to other nodes on a TCP/IP network with DOS, Microsoft Windows, VMS™, and HP-UNIX platforms. BOOTP configuration files let you dynamically assign IP addresses to PLC-5/20E, -5/40E, and -5/80E processors, and to PLC-5 and Pyramid Integrator Ethernet Interface modules. You can obtain subnet masks and gateway addresses from BOOTP.

A BOOTP server must exist on the Ethernet network before you can configure a BOOTP client. The server is a computer (PC, VAX, or UNIX® system) that has BOOTP server software installed.

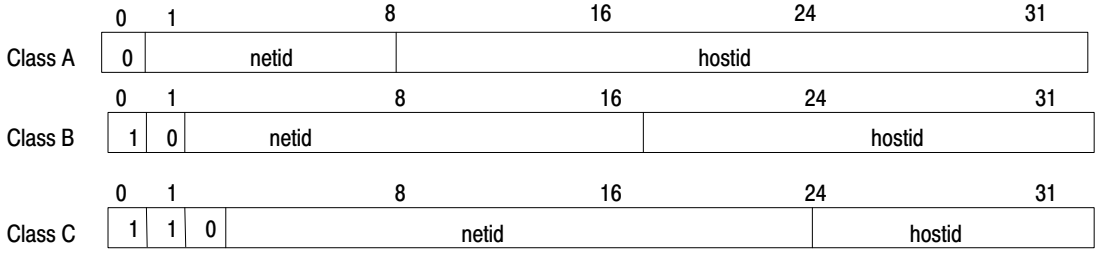
If BOOTP is enabled in the processor on power-up, the processor sends a message to the BOOTP server on the network with its hardware address. The BOOTP server compares that hardware address to those in its look-up table in the configuration file and sends a message back to the processor with the appropriate IP address. With all hardware and IP addresses in one location, you can easily change IP addresses in the BOOTP configuration file if your network needs to be changed. The factory default is BOOTP enabled.

If BOOTP is disabled (or there is no BOOTP server on the network), you must use 6200 or AI5 software to enter/change the IP address for each processor.

IP Addresses

Each TCP/IP node on a network must have a unique IP address. The TCP/IP Ethernet Interface is such a node, as is a PC running TCP/IP. There may be other nodes on the network that are not involved with communications to the PLCs, but no matter what their function, each TCP/IP node must have its own IP address. The IP address identifies each node on the IP network (or system of connected networks).

The IP address is 32 bits long and has a netid part and a hostid part. Each network is a Class A, Class B, or Class C network. The class of a network determines how an IP address is formatted.



Each node on the same physical network must have an IP address of the same class and must have the same netid. Each node on the same network must have a different hostid thus giving it a unique IP address. IP addresses are written as four decimal integers (0-255) separated by periods where each integer gives the value of one byte of the IP address. For example, the 32-bit IP address:

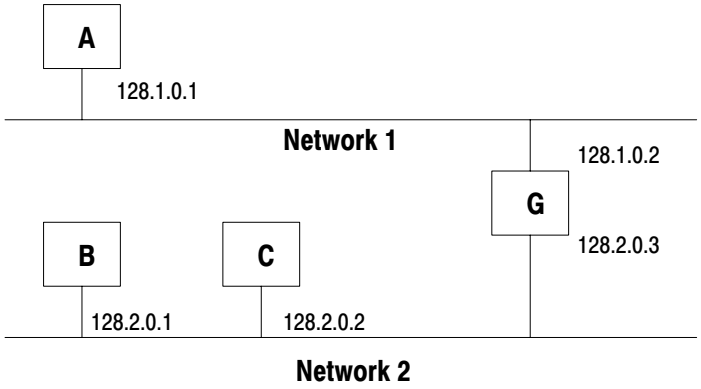
00000011 00000000 00000000 00000001 is written as 3.0.0.1.

You can distinguish the class of an IP address from the first integer in its dotted-decimal IP address as follows:

Range of first integer	Class	Range of first integer	Class
0 -127	A	192 - 223	C
128 -191	B	224 - 255	other

Gateways

Gateways connect individual physical networks into a system of networks. When a node needs to communicate with a node on another network, a gateway transfers the data between the two networks. The following figure shows gateway G connecting Network 1 with Network 2.



When host B with IP address 128.2.0.1 communicates with host C, it knows from C's IP address that C is on the same network. In an Ethernet environment, B can then resolve C's IP address to a MAC address (via ARP) and communicate with C directly.

When host B communicates with host A, it knows from A's IP address that A is on another network (the netids are different). In order to send data to A, B must have the IP address of the gateway connecting the two networks. In this example, the gateway's IP address on Network 2 is 128.2.0.3.

The gateway has two IP addresses (128.1.0.2 and 128.2.0.3). The first must be used by hosts on Network 1 and the second must be used by hosts on Network 2. To be usable, a hosts's gateway must be addressed using a netid matching its own.

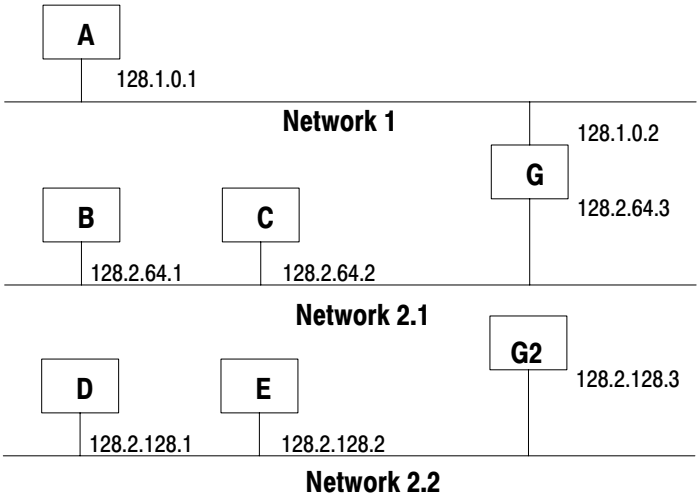
Subnets

Subnet addressing is an extension of the IP address scheme that allows a site to use a single netid for multiple physical networks. Routing outside of the site continues as usual by dividing the IP address into a netid and a hostid via the class. Inside a site, the subnet mask is used to redivide the IP address into a custom netid portion and hostid portion. Consider taking Network 2 (a Class B network) in the previous example and adding another physical network. Selecting the following subnet mask would add two additional netid bits allowing for four physical networks:

```
11111111 11111111 11000000 00000000 = 255.255.192.0
```

In effect, two bits of the Class B hostid have been used to extend the netid. Each unique combination of bits in the part of the hostid where subnet mask bits are 1 specifies a different physical network.

The new configuration would be:



A second network with Hosts D and E has been added. Gateway G2 connects Network 2.1 with Network 2.2. Hosts D and E will use Gateway G2 to communicate with hosts not on Network 2.2. Hosts B and C will use Gateway G to communicate with hosts not on Network 2.1. When B is communicating with D, G (the configured Gateway for B) will route the data from B to D through G2.

Simple Network Management Protocol (SNMP)

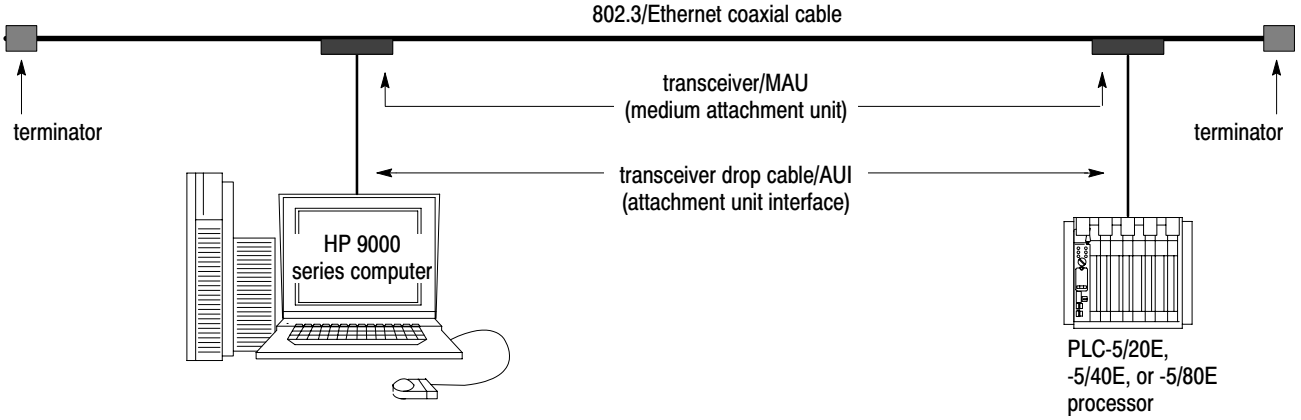
Simple Network Management Protocol (SNMP) is a standard for network management within TCP/IP environments. The SNMP agent has been implemented in the Ethernet PLC-5™ processors (page 2-2) and the Ethernet Gateway (page 2-3). This lets client applications monitor and manage network information on host computers and gateways. Network administrators run programs that use SNMP to manage their networks.

features

- industry standard for TCP/IP-based networks
- SNMP agent implementation on the Ethernet PLC-5 processors, PLC-5 Ethernet Interface module, and Gateway responds to inquiries from a client
- supported by available network management software products designed for TCP/IP SNMP environments, e.g., HP OpenView Node Manager, Network General Sniffer, etcetera
- Allen-Bradley products can be managed along with other vendors' products as a uniform network

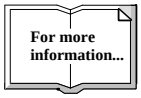
Network Components

The basic Ethernet TCP/IP system is made up of medium attachment units (MAUs), which are also called transceivers, and attachment unit interfaces (AUIs), also called transceiver drop cables. This figure shows traditional Ethernet network components and their connections.



The MAUs need to match the cable type. Some Ethernet communication cards for PCs incorporate 10base2 or 10baseT MAUs on board. The AUIs need to match the Ethernet communication interface type, 802.3 or Ethernet. Using the incorrect type may actually work, but due to differences in AUI wiring grounds, noise problems may result.

Important: Pyramid Integrator™ needs a MAU with low current draw (under 0.35A) and SQE enabled (also known as Ethernet heartbeat).



If you need additional information about TCP/IP and internetworking, we suggest that you read:

Internetworking with TCP/IP – Vol. 1 by Douglas E. Comer	ISBN 0-13-468505-9
The Ethernet Management Guide —Keeping The Link	ISBN 0-07-046320-4
An Introduction to TCP/IP	ISBN 3-540-96651-*X*
Computer Networks by Andrew S. Tanenbaum	ISBN 0-13-162959-*X*

Allen-Bradley Ethernet TCP/IP Applications

Overview

Allen-Bradley takes a systemic approach to the introduction of products having Ethernet TCP/IP connectivity so that all have the necessary features and functions to interoperate and all can be managed as a uniform network.

This chapter describes:

- how to integrate Allen-Bradley products into your present system
- the benefits of doing so
- the features that enable you to do so

For ordering information and specifications, see chapter 3.

Benefits

Compatibility between all environments on an Ethernet network.
You can add TCP/IP and Allen-Bradley products to your Ethernet network without disturbing your current environment (Novell®, MAP, or DECnet).

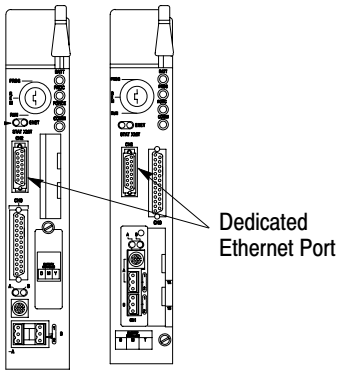
Maximizes communication between the great variety of equipment available from many manufacturers.
You have near-limitless networking possibilities.

Rely on Allen-Bradley support and service.
Allen-Bradley offers these support services:

- technical training
- engineering and field services
- repair and exchange services
- technical support
- SupportPlus program, which includes:
  - telephone support
  - technical subscription service
  - software and documentation updates
  - remote system diagnostics

Ethernet PLC-5 Processors

Cat. Nos. 1785-L20E, -L40E, and L80E



PLC-5/20E processor

PLC-5/40E, & -5/80E processors

The Ethernet PLC-5/20E™, -5/40E™, and -5/80E™ processors offer embedded Ethernet TCP/IP communication capabilities; these processors provide the integration of Allen-Bradley architecture into the industry standard Ethernet TCP/IP system, offering flexible, open-system solutions.

With the Ethernet processors' built-in communication capabilities, you have access to the entire Allen-Bradley control, communication, and information architecture. The Ethernet processors are optimized for real-time sequential and regulatory control and offer extensive application flexibility.

features

- built-in TCP/IP communication
- client/server protocol with RSLinx and INTERCHANGE in FLASH memory
- as many as 64 application/user connections per PLC-5 processor
- built-in SNMP-based station management agent
- high performance peer-to-peer communication between processors on Ethernet using a standard message instruction

PLC-5 Ethernet Interface Module

Cat. No. 1785-ENET

The PLC-5 Ethernet Interface Module is a single-slot module that attaches to the side enhanced PLC-5 processors (except series A -5/40 and -5/60) to provide Ethernet connectivity to the processor.

When you use it with a(n)	The interface module provides
Enhanced PLC-5 processor	Ethernet connectivity without sacrificing DH+/RIO ports
ControlNet PLC-5 processor	Ethernet connectivity
Ethernet PLC-5 processor	the ability to operate dual Ethernet links

Use the PLC-5 Ethernet Interface module with a programming software package. If you use 6200 programming software, you must use release 5.21 and later; if using PLC-5 A.I., you must use release 7.23 or later. In addition, with both products you must use one of the following current firmware revisions for PLC-5 processors:

Processor	Model	Series	Revision
Enhanced	PLC-5/11, -5/20, -5/26, -5/30, -5/40, -5/40L, -5/46, -5/46L, -5/60, -5/60L, -5/80, -5/86	D	B
		C	K
Enhanced	PLC-5/40, -5/40L, -5/46, -5/46L, -5/60, -5/60L	B	L
	PLC-5/30	A	L
	PLC-5/11, -5/20, -5/26	A	K
ControlNet	PLC-5/20C, -5/40C, -5/60C, -5/80C	D	B
	PLC-5/20C, -5/40C	C	K
Ethernet	PLC-5/20E, -5/40E, -5/80E	D	B
		C	K

Ethernet Gateway to Data Highway Plus™

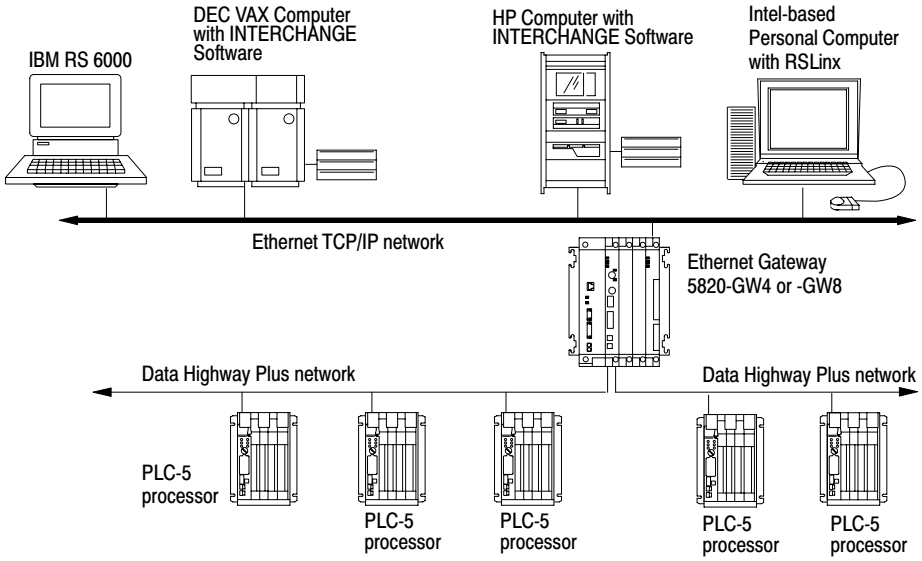
5820-GW4, -GW8

The Allen-Bradley Ethernet Gateway system provides a high-speed, low-cost gateway from Ethernet-based computing systems to Data Highway Plus communication networks. The Ethernet Gateway lets you integrate Allen-Bradley control information with your Hewlett-Packard® or DEC® host, or personal computer system without significant new engineering or programming costs.

The Gateway combines a Pyramid Integrator (PI) Ethernet Interface (EI) module, described on page 2–4, and a Resource Manager (RM) module in a 4-slot or 8-slot PI chassis and Rockwell Software INTERCHANGE or RSLinx software installed in the host computer.

INTERCHANGE and RSLinx software are standard application programming interfaces (API) to real-time data. They reduce integration time and expense by providing a common set of data access calls for A-B control systems.

INTERCHANGE supports communication between minicomputers (running on Digital Unix, Solaris, AIX, HP-UX™, or OpenVME) and the PI or PLC-5 Ethernet Interface module or PLC-5 processors. RSLinx provides the same communication support on the Microsoft 32-bit operating system, Windows NT, and Windows 95.



The PI Ethernet Interface module provides an Ethernet Gateway between the host system and all connected Data Highway Plus (DH+™) networks. The RM1 module provides communication channels for two DH+ networks and a port for RS-232/422/423 devices. The PI chassis may have up to four 5130-KA modules with each module supporting two additional DH+ networks. In this configuration, the Ethernet Gateway supports communication with as many as 10 unique DH+ segments.

features

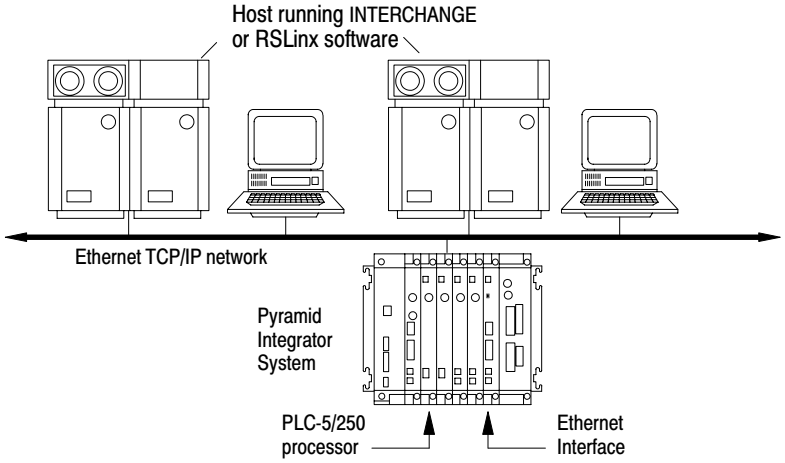
- PLC processor program support
  Monitor and maintain your entire PLC-based control system from a single workstation located anywhere on your Ethernet network.
- easy network management
  The Ethernet Interface system supports SNMP (Simple Network Management Protocol) and will integrate with standard TCP/IP network management software.
- provides PLC processor program security
  Valuable PLC processor programs may be securely maintained on computer disk.
- protects your software investment
  INTERCHANGE or RSLinx software insulates your applications from changes in plant-floor networking. It lets you start with small DH Plus-based systems and migrate to Ethernet-based architectures without rewriting your applications.

Pyramid Integrator Ethernet Interface Module

Cat. No. 5820-EI

The Pyramid Integrator Ethernet Interface module provides industry-standard Ethernet TCP/IP connections between PLC-5/250™ processors (and other modules in the PI chassis) and HP 9000, VAX/VMS, and Intel i386 and i486 personal computers that have INTERCHANGE or RSLinx software installed in them.

Host Computer:	and This Communication Product:	Are Compatible With:
UNIX Box	INTERCHANGE	Open VMS, VAX, Alpha, HP-UX, Solaris, AIX
Intel-based PC	RSLinx	Windows NT or '95



features

- supports installed base of PLC processors on the Allen-Bradley Data Highway
- reduces system integration cost
- lets customers use existing host computers
- host computers can be sized to application requirements
- implements standard SNMP (Simple Network Management Protocol)

Control Coprocessor

Cat. Nos. 1771-DMC, 1771-DMC1, 1771-DMC4, and 1771-DXPS Expander Module

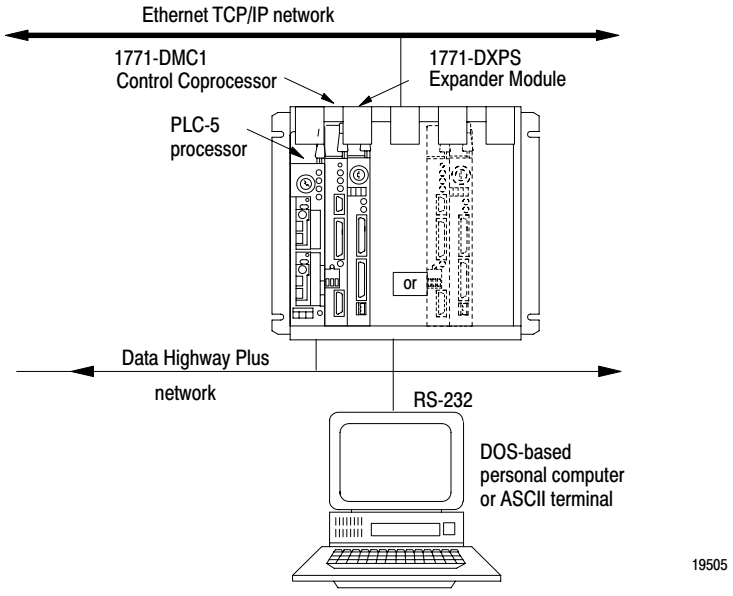
The 1771 Control Coprocessor is a single-slot 1771 module that expands the capability of your PLC processor system by letting you run programs in C, BASIC, and assembler languages in a real-time, multitasking operating system (OS/9) environment. These programs run independently of the PLC processor control logic but have access to PLC processor memory.

The Control Coprocessor performs a wide range of functions including:

- complex math or application-specific algorithms
- memory-intensive production scheduling or data logging/trending
- high-speed search and compare of very large files or look-up tables
- protocol conversion to interface a PLC processor with field devices

The industrially-hardened module fits in a 1771 chassis and offers direct communication with enhanced PLC-5 processors (PLC-5/11™, -5/20™, -5/20E, -5/30™, -5/40™, -5/40E, -5/40L™, -5/60™, -5/60L™, and -5/80™, PLC5/80E) and standard I/O communication with all PLC-2®, PLC-3®, and PLC-5 processors.

An optional expander module provides two additional serial communication ports, a keyswitch for reinitializing the Control Coprocessor without cycling power, and a 4-digit alphanumeric display for diagnostic reporting.



features

- develop programs in C, BASIC, or assembly language using a DOS-based personal computer or an ASCII terminal
- real-time, multitasking, multiuser operating system
- resides in a 1771 I/O chassis and communicates with the PLC-2, -3, or -5 processor by backplane (block transfer); and communicates directly with enhanced PLC-5 processors.
- modular design – invest only in the memory and functionality that you need
- communicates with external devices via industry-standard Ethernet TCP/IP or serial communication ports
- INTERCHANGE server support included
- SNMP support for network management

Control Coprocessor Connectivity

The 1771-DMC1 and 1771-DMC4 configurations provide TCP/IP-based communication in conjunction with real-time applications that are integrated with enhanced PLC-5 processors. Resident on the module are the standard TCP/IP virtual-terminal and file-transfer utilities (telnet and ftp). This system is compatible with most standard TCP/IP-based network devices. Applications communicate across Ethernet by using the TCP/IP socket driver interface or via INTERCHANGE software.

With the INTERCHANGE server in the control coprocessor, the processor can respond to read/write requests from Ethernet PLC-5 processors or host computer applications. Programs in the attached PLC-5 processor cannot, however, initiate message instructions to other Ethernet PLC-5 processors or host applications.

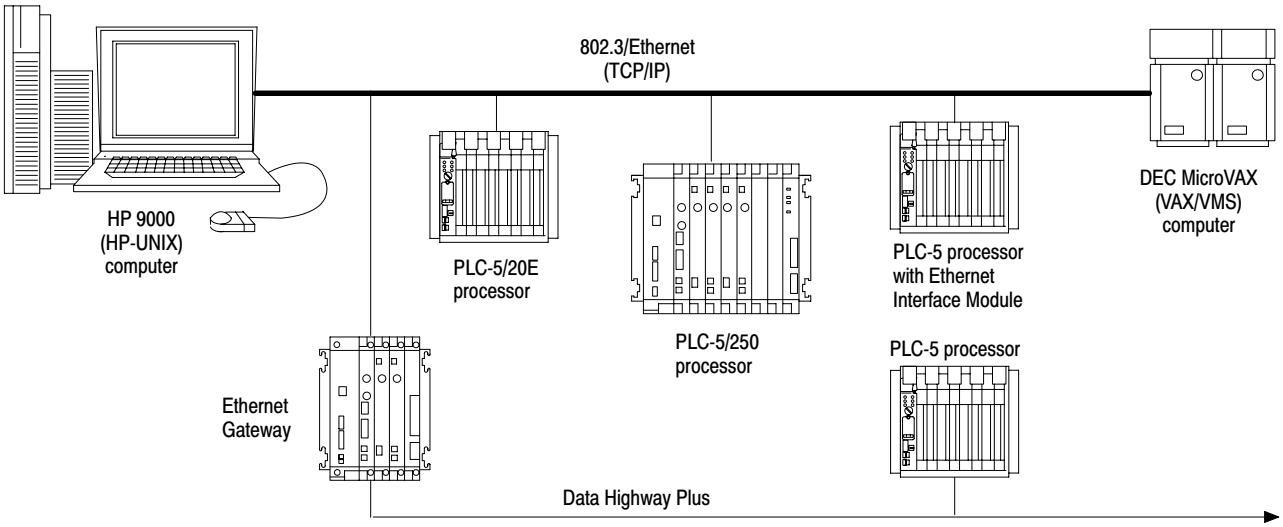
Important: Use 1785 series AUI or transceiver cables and kits for the Control Coprocessor.

INTERCHANGE Software

Cat. Nos. 9351-VS, -HPUS, -DKTS, -WKTS, -WES, -AIX, -SLRS, -OSF (and Run Time (RT) equivalents)

INTERCHANGE software is an application programming interface (API) that provides a host computer with a library of functions and executable commands to access data table memory or files in Allen-Bradley PLC processors. It takes advantage of standard TCP/IP utilities and services for implementation of data acquisition and control applications.

INTERCHANGE supports communication between minicomputers (running on Digital Unix, Solaris, AIX, HP-UX™, or OpenVME) and the PI or PLC-5 Ethernet Interface module or PLC-5 processors. (RSLinx provides the same communication support on the Microsoft 32-bit operating system, Windows NT, and Windows 95.)



You can reduce your system development time and minimize your long-term maintenance costs with INTERCHANGE software. The consistent APIs let your host computers gather information from your programmable controllers to integrate your control and information processing systems.

INTERCHANGE software uses calls and features that help reduce the time and cost of developing and integrating applications. Software products using INTERCHANGE are also integrated into a large selection of third-party application software solutions.

The flexibility of INTERCHANGE software lets you choose the right size host computer to fit your application.

Allen-Bradley PLC Station Access

Besides letting you transfer data between your host and PLC processors, INTERCHANGE software also lets you collect data and pass it to other plant computers via Ethernet links or DH+ links.

INTERCHANGE software reduces system testing and on-site integration costs, and insulates applications from changes in plant-floor networking and plant-floor technology.

Ethernet Compatible

INTERCHANGE software uses your existing network architecture. Use INTERCHANGE software with SNMP network diagnostics for open systems network management and support.

High-speed Communicaton Links

INTERCHANGE software supports multiple concurrent control programs providing tighter closed-loop feedback control. With INTERCHANGE software, you can access PLC processor stations three to five times faster than through RS-232-C links, and the host can process as many as 230 transactions per second.

Rockwell Software Reliability

Rockwell Software has rigorously tested INTERCHANGE software and stands behind it with support and service.

INTERCHANGE Connectivity

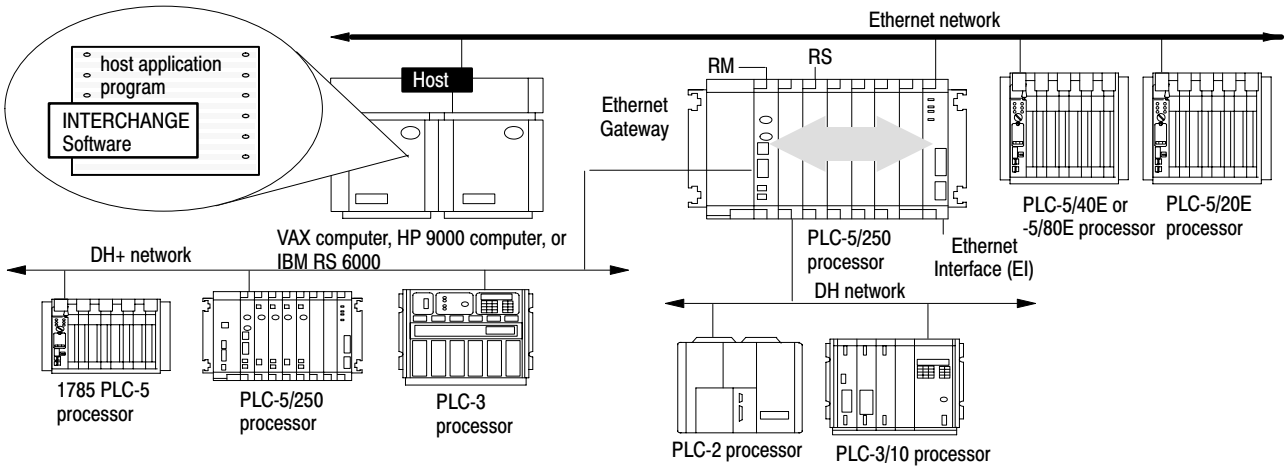
INTERCHANGE software lets host application programs transfer data to and from the data table memory of PLC-5E processors, the PLC-5 Ethernet Interface module, PLC-5/250 processors, other Pyramid Integrator modules, and Allen-Bradley processors connected on Data Highway/Data Highway Plus (DH/DH+) links. INTERCHANGE software function calls are integrated into your C application programs, or may already be integrated into your favorite application software package.

You can run INTERCHANGE software for Ethernet TCP/IP with:

- HP 9000 computers running HP-UX
- VAX/VMS host computers
- AIX
- Solaris
- OSF/1

INTERCHANGE Example Application

As an example application, you can run INTERCHANGE software on an HP 9000, DEC VAX, or IBM RS 6000 computer on an Ethernet TCP/IP network that interfaces application software to Ethernet PLC-5 processors, PLC-5 Ethernet interface module, PLC-5/250 processors, and PLC processors on DH+ links connected to an Ethernet Gateway.



RSLinx Software

Cat. Nos. 9355-WAB, -WABOEM, and -WABC

RSLinx software is a complete 32-bit product family that provides communication to a range of applications and includes 50 of the most popular INTERCHANGE software C API calls. It supports Rockwell Software and A-B programming, MMI, and component software products.

RSLinx software can provide plant-floor data to commercially available DDE client applications such as Microsoft Excel and Access for display, logging, or trending. You can set individual parameters or download recipes to supported devices from a supervisory computer. Additionally, RSLinx software supports many popular industrial applications that were developed by OEMs, VARs, and independent software vendors using the RSLinx C application programming interface (API).

RSLinx Lite, although not commercially available, is bundled with many Rockwell Software and A-B software products. It offers direct driver connections to PLC processors to support many Rockwell Software programming packages.

RSLinx OEM software acts as a communication engine for many Rockwell Software MMI software products as well as for any third-party product that uses the RSLinx C API. RSLinx software not only includes the functionality of RSLinx OEM, but adds DDE communication to all products that can act as DDE clients such as Microsoft Excel.

RSLinx C SDK software is a development kit for creating custom applications that use the C API communication capabilities of RSLinx and RSLinx OEM software.

Features and Benefits

RSLinx software is available in packages that suit a variety of features and functionality, as shown in the table below.

	RSLinx Lite	RSLinx OEM 9355-WABOEM	RSLinx 9355-WAB	RSLinx C SDK 9355-WABC
A-B drivers for Ethernet 1784-KT, -KTX, -PCMK, and serial DF1 full duplex	X	X	X	
LINX Gateway and InterLinx Gateway client driver	X	X	X	
Driver and station diagnostics	X	X	X	
Support for Rockwell Software and A-B programming software	X	X	X	
Support for Rockwell Software MMI and component software		X	X	
Support for applications developed for the RSLinx C API		X	X	
AdvanceDDE diagnostics		X	X	
Support for standard DDE client applications			X	
Ladder editor/viewer			X	
Graphical Super Who	X	X	X	X
Documentation and files required to develop an application that uses the RSLinx C API				X

RSLinx Applications

- Operator Interface software such as WINtelligent View and RSView software
- Special-purpose software such as RSTrend, WINtelligent QUALITY, and WINtelligent RECIPE software
- Custom applications using Visual C++ or Visual Basic
- Windows programs such as Microsoft Excel, Microsoft Access, and Lotus 1-2-3 for Windows

Compatibility

- PLC-5 A.I. Series Programming Software
- RSLogix 500 Software
- RSView Software
- RSTrend Software
- all AdvanceDDE WINtelligent Series applications
- Wonderware FastDDE to Wonderware Intouch
- Microsoft XL_Table
- Microsoft CF_Text

6200 Series Programming Software

Cat. Nos. 9321-PLC5 and 9323-PLC5

Use 6200 series programming software for programming and documenting control programs on line or off line for PLC-2, PLC-3, PLC-5, and PLC-5/250 family processors. The software includes a universal programming interface that provides a similar 'look and feel' across processor families. Menus, configuration parameters, and program editors follow a common format. Once you learn one, you'll be familiar with the others.

The PLC-5 and PLC-5/250 programming software packages is supported on the DOS platform. You can use 6200 DOS in Windows with INTERCHANGE software drivers. You can also use 6200 DOS in an RSView Application Window environment to access PLC-5 and PLC-5/250 processors over DH+ or Ethernet links.

6200 series programming software can now support programming and upload/download operations over Ethernet to the PLC-5 Ethernet Interface module, Ethernet PLC-5 processors, PLC-5/250 processors, and through an Ethernet Gateway to PLC processors on DH+ links.

You need an Ethernet PC card, cat. no. 6628-A5, and FTP Software's PC/TCP software for Ethernet programming with 6200 Software. See page 4-4 for additional connectivity information.

PLC-5 A.I. Series Programming Software

Cat. Nos. 9321-L5160, 9323-L5300, 9325–L5140, and 9341-L5200

PLC-5 A.I. Series is an easy-to-use, menu- and function-key driven software package for programming the Allen-Bradley PLC-5 family of processors. Its features enable beginners to quickly become proficient in ladder logic development and documentation. Advanced users will find the powerful editing and diagnostic tools to be great time-savers during ladder program development and troubleshooting. Online and offline modules offer complete programming, documentation, and reporting, as well as upload/download capabilities. The help system assists you with unique features of the software, as well as specific information on the PLC processor's instruction set.

Rockwell Software also offers an A.I. Series Processor Emulation Module. Processor Emulation provides a convenient means for testing and debugging ladder logic offline on your computer. Using emulation you can troubleshoot your program one scan at a time and add breakpoints to trap unexpected program conditions.

Features and Benefits

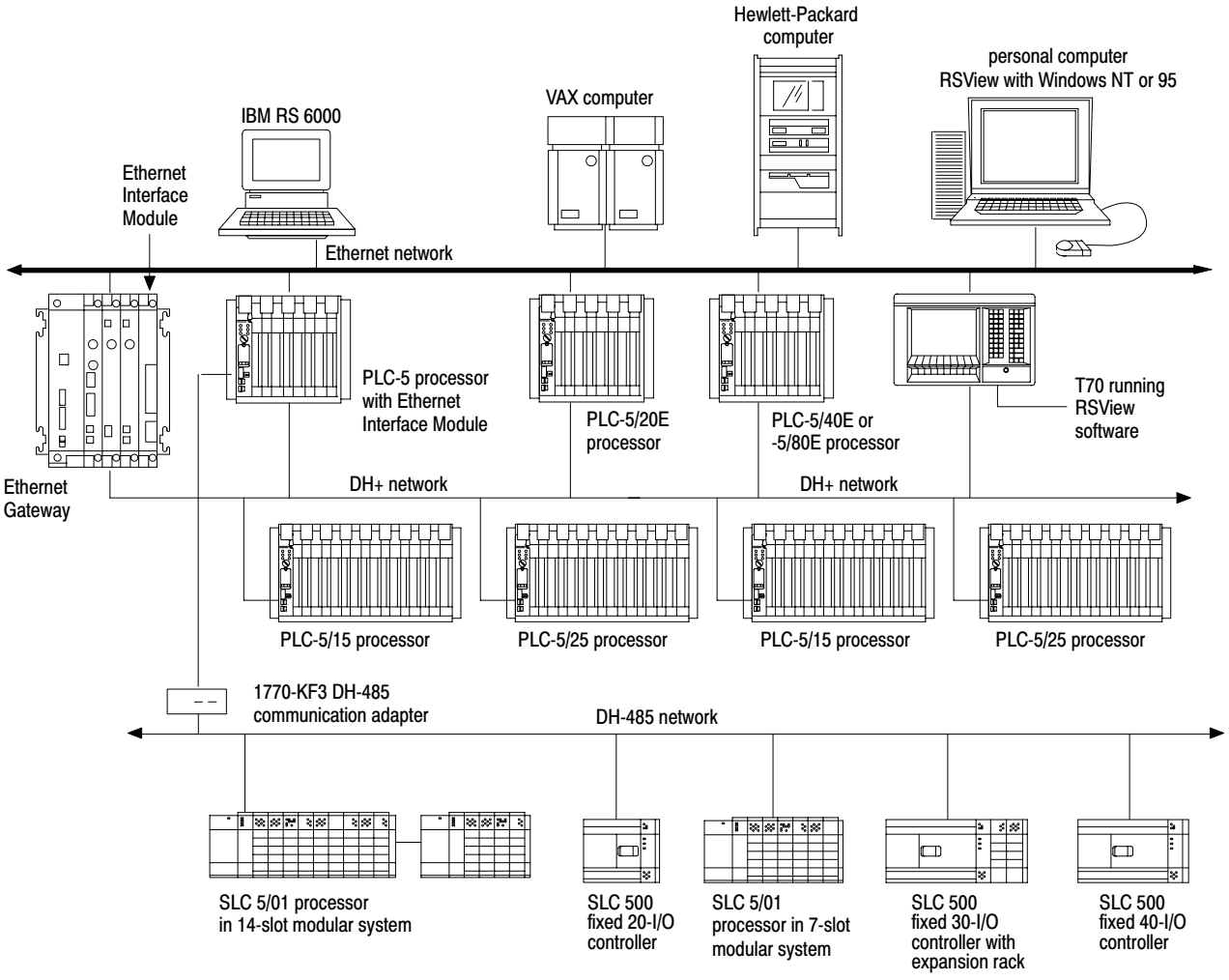
- Displaying of cross-reference information from the data table
- Offline & online data table usage reports
- Extended memory support
- 1771 N Series analog module support

- Partial download – Select specific program or data table files to be downloaded instead of a complete ladder program
- Sequencer display screens and reports
- RSLinx and RSEmulate 5 support
- Visual Branching
- Configurable Custom Data Display Screen Size
- SFC and Structured Text Programming
- Optional Software (PLC-5 A.I. Series Processor Emulation, PID Logistics for PLC-5, RSLinx, and RSEmulate 5 software)

RSView Man/Machine Interface Software

Cat. Nos. 9301 Series

RSView software is a modular set of software products that integrates data acquisition, supervisory control, and information management in one package. It uses any and all network layers supported by Windows.



With RSView software products, you can meet the demands of industrial supervisory and control applications that require operator interaction with plant-floor devices. You get fast, reliable data acquisition, data manipulation, monitoring, and supervisory control of the plant floor and communications with higher-level plant and corporate computers. You can also display several screens simultaneously with RSView software's multitasking, multiwindowed environment.

RSView Connectivity

RSView uses any and all network layers supported by Windows. To share data between computers, you must use NetDDE properly configured as a Windows function. Configuration varies from one operating system to another for Windows 95, NT3.51, and NT4.0.

Because RSView supports the Windows standard networking layer, there is no need to list compatible network cards (as with CVDos). When Windows networking works, so does RSView.

Sharing Tag Values with RSView

RSView works as both a DDE server and client. This lets you share tag values with a wide range of devices and with other Windows applications. You can exchange tag values:

- within one computer using DDE
- over a network using NetDDE

RSView as DDE Server/Client

When RSView acts as:	It:
DDE Server	provides tag values to other Windows applications such as Microsoft Excel or another RSView project
DDE Client	requests tag values from other Windows applications such as WINLinx or another RSView project

To request data from RSView, a client application uses a *reference formula* that specifies where the data will come from by specifying:

- application: RTData
- topic project name
- item tag name

RSView with NetDDE

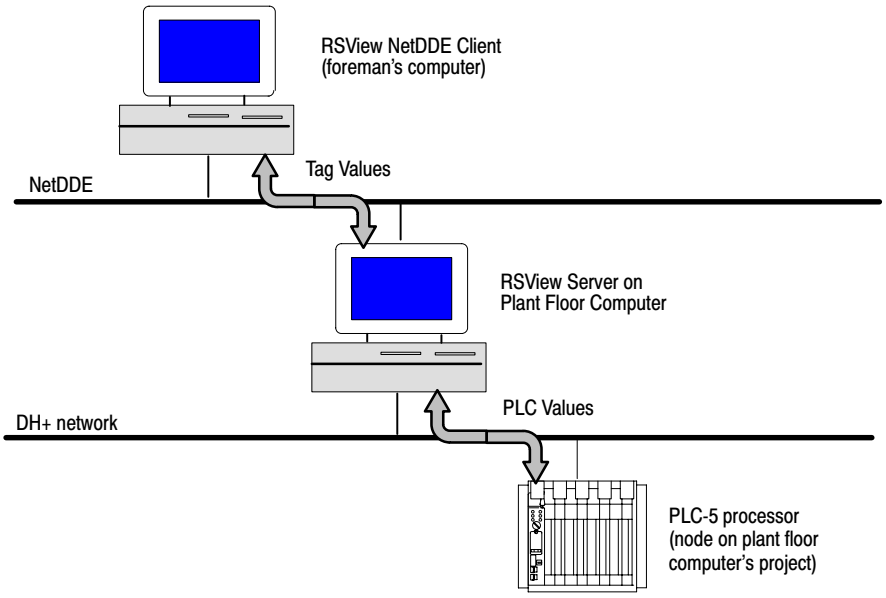
To use NetDDE, your *reference formula* specifies the name of the computer assigned when setting up networking in Windows. To access RSView's DDE server from a client application running on a different computer from RSView, you would use this syntax:

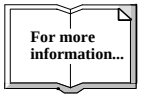
- application: \\ComputerName\NDDE$
  (computer you want to access set up in Windows)
- topic RTDataProjectName$
  (object running on the computer you want to access)
- item tag name

For example, you can include the tag in a graphic display and its value will be updated when needed. You can also write to the tag.

Example use of NetDDE to access tags in a remote RSView

An RSView computer on the plant floor contains a tag called RejectCount. You want to include this tag's value in a graphic display on your foreman's computer.





If you want more information about Allen-Bradley products:

- see that product's literature
- see the Automation Systems Catalog, publication B-111
- contact your local Allen-Bradley sales representative or distributor

Ordering Components

Overview

This chapter lists catalog numbers for ordering Ethernet components.

Transceiver Kits, AUI Cables, and Terminators

Order transceiver/cable kits, or separate transceivers or AUI cables for PLC-20E, -40E, -80E enhanced processors and for the Pyramid Integrator Ethernet Interface module from the following table.

For the kit, order Cat. No.	Or, for these separate items:	Order Cat. No.
5810-TAM Thinwire	Thinwire Ethernet/802.3 Transceiver	5810-AXMT
	Ethernet/802.3 Transceiver Cable (15M)	5810-TC15
5810-TAS Thinwire	Thinwire Ethernet/802.3 Transceiver	5810-AXMT
	Ethernet/802.3 Transceiver Cable (2M)	5810-TC02
5810-TBM Thickwire	Thickwire Ethernet/802.3 Transceiver	5810-AXMH
	Ethernet/802.3 Transceiver Cable (15M)	5810-TC15
5810-TBS Thickwire	Thickwire Ethernet/802.3 Transceiver	5810-AXMH
	Ethernet/802.3 Transceiver Cable (2M)	5810-TC02

Order transceiver/cable kits, or separate transceivers or AUI cables for the Control Coprocessor and PLC-5 Ethernet Interface module:

For the kit, order Cat. No.	Or, for these separate items:	Order Cat. No.
1785-TAM Thinwire	Thinwire Ethernet/802.3 Transceiver	1785-AXMT
	Ethernet/802.3 Transceiver Cable (15M)	1785-TC15
1785-TAS Thinwire	Thinwire Ethernet/802.3 Transceiver	1785-AXMT
	Ethernet/802.3 Transceiver Cable (2M)	1785-TC02
1785-TBM Thickwire	Thickwire Ethernet/802.3 Transceiver	1785-AXMH
	Ethernet/802.3 Transceiver Cable (15M)	1785-TC15
1785-TBS Thickwire	Thickwire Ethernet/802.3 Transceiver	1785-AXMH
	Ethernet/802.3 Transceiver Cable (2M)	1785-TC02

You can purchase these transceivers and cables separately by using the individual catalog numbers in the tables.

- AUI cables

For these products:	For 802.3 AUI cable:	Order cat. no.:
Control Coprocessor PLC-5 Ethernet Interface	2M	1785-TC02
	15M	1785-TC15
Enhanced PLC-5 Processors PI Ethernet Interface	2M	5810-TC02
	15M	5810-TC15

  – Allen-Bradley Ethernet cards for T60s or equivalent machines have a built-in 10base2 MAU, so no AUI cable is required. If you need a 10base5 connection, use a 1785-TC02 or -TC15 cable.

- Transceivers

For:	For MAU:	Order cat. no:	For:	For MAU:	Order cat. no:
CoProcessor & PLC-5 EI	10base5	1785-AXMH	Enhanced PLC-5, PI Ethrnet Interface	10base5	5810-AXMH
	10base2	1785-AXMT		10base2	5810-AXMT

- Terminators
  For 10base2 thinwire networks, order 5810-TER BNC

Bridges, Gateways, Routers, and Repeaters

These companies supply bridges, gateways, routers, and repeaters:

Anixter
Worldwide Headquarters
4711 Golf Road
Skokie, IL 60076
(708) 677–2680 or
1-800–ANIXTER

Black Box Corporation
P.O. Box 12800
Pittsburgh, PA 15241
(412) 746-5500

Cabletron Systems
35 Industrial Way
P.O. Box 5005
Rochester, NH 03867
(603) 332-9400

Chipcom Corporation
Southborough Office Park
118 Turnpike Road
Southborough, MA 01772
(508) 460-8900

Cisco Systems
1525 O'Brien Drive
P.O. Box 3075
Menlo Park, CA 94026
(415) 326-1941

SynOptics Corporation
4401 Great American Parkway
P.O. Box 58185
Santa Clara, CA 95052
(408) 988-2400

Ethernet PLC-5 Processors

If you want an Ethernet PLC-5 processor with:	Order catalog number:
16K memory and 512 I/O points	1785-L20E
48K memory and 2,048 I/O points	1785-L40E
100K memory and 3,072 I/O points	1785-L80E

PLC-5 Ethernet Interface Module

If you want:	Order catalog number:
PLC-5 Ethernet Interface Module	1785-ENET

Ethernet Gateway to Data Highway Plus

If you want:	Order Catalog number:
Ethernet Gateway for DEC, Open/VMS VAX™, AXP, AIX for RS 6000, Sun Solaris, Windows, and HP 9000™ HP-UX computers (includes 4-slot chassis, 5110-A4). Software not included.	5820-GW4
Ethernet Gateway for DEC, Open/VMS, AXP, AIX for RS 6000, Sun Solaris, Windows, and HP 9000 HP-UX computers (includes 8-slot chassis, 5110-A8). Software not included.	5820-GW8
Catalog numbers above are bundled systems that include:	
Pyramid Integrator 4- or 8-slot chassis	5110-A4 or 5110-A8
Filler plate	5110-FP
Pyramid Integrator power supply	5120-P1
Design and installation documentation	5110-ISET
128K Resource Manager Module	5130-RM1
Ethernet Interface Module	5820-EI

Pyramid Integrator Ethernet Interface Module

If you want the:	Order catalog number:
Ethernet Interface module	5820-EI

Control Coprocessor

If you want this Control Coprocessor product:	Order catalog number:
Main Module - 1 Mbyte with Ethernet	1771-DMC1
Main Module - 4 Mbytes with Ethernet	1771-DMC4
Expander Module - 2 ports, keyswitch, and display	1771-DXPS
PC Bridge Program Development and Cross Compiler Software	1771-PCB

INTERCHANGE Software

For this Operating System:	Order Cat No:	Release:	Media:
Micro-VAX / A-B Pyramid Integrator	9351-DTLS	3.1.1	TK50 tape
Open VMS	9351-VS	6.0.3	
DEC UNIX OSF/1	9351-OFS		tape
HP-UX (Ethernet) (1)	9351-HPUS	6.0.3	HP DAT tape
MS-DOS	9351-DKTS	6.0.3	3.5” disk
Windows(Ethernet)	9351–WES	6.0.3	3.5” disk
Windows (KT)	9351-WKTS	6.0.3	3.5” disk
AIX (RS/6000	9351-AIX	6.0.3	tape
Solaris (SPARC)	9351-SLRS	6.0.3	tape
(1) can access PLC processors on DH/DH+ via the PI system or LINX gateway, or can access SLC processors on DH1-485 via the same plus 1785-KA5 bridge			

RSLinx Software

If you want:	Order catalog number:
RSLinx Software	9355–WAB
RSLinx OEM Software	9355-WABOEM
RSLinx C SDK Software	9355-WABC

6200 Series Programming Software

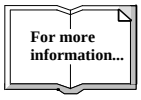
If you want:	Order catalog number:
online and offline capabilities	9323–PLC5
offline only capabilities	9321–PLC5

PLC-5 A.I. Series Software

If you want:	Order catalog number:
PLC-5 A.I. Series Offline Programming Software	9325-L5140
PLC-5 A.I. Series Online Programming Software	9321-L5160
PLC-5 A.I. Series Offline/Online Programming Software	9323-L5300
PLC-5 A.I. Series Processor Emulation Software	9341-L5200

RSView Man/Machine Interface Software

If you want:	Cat No for 95 & NT:	Cat No for 95:	Cat No for NT:
Works	9301-2SE-2400	–	–
Works w/ WINtelligentLINX	–	9301-2SE-2401	–
Works w/ RSLINX	–	–	9301-2SE-2402
Runtime	9301-2SE-3400	–	–
Runtime w/ WINtelligentLINX	–	9301-2SE-3401	–
Runtime w/ RSLINX	–	–	9301-2SE-3402
Works 1500	9301-2SE-2300	–	–
Works 1500 w/ WINtelligentLINX	–	9301-2SE-2301	–
Works 1500 w/ RSLINX	–	–	9301-2SE-2302
Runtime 1500	9301-2SE-3300	–	–
Runtime 1500 w/ WINtelligentLINX	–	9301-2SE-3301	–
Runtime 1500 w/ RSLINX	–	–	9301-2SE-3302
Works 300	9301-2SE-2200	–	–
Works 300 w/ WINtelligentLINX	–	9301-2SE-2201	–
Works 300 w/ RSLINX	–	–	9301-2SE-2202
Runtime 300	9301-2SE-3200	–	–
Runtime 300 w/ WINtelligentLINX	–	9301-2SE-3201	–
Runtime 300 w/ RSLINX	–	–	9301-2SE-3202
Works 150	9301-2SE-2100	–	–
Works 150 w/ WINtelligentLINX	–	9301-2SE-2101	
Works 150 w/ RSLINX	–	–	9301-2SE-2102
Runtime 150	9301-2SE-3100	–	–
Runtime 150 w/ WINtelligentLINX	–	9301-2SE-3101	–
Runtime 150 w/ RSLINX	–	–	9301-2SE-3102



For more information about ordering your system's requirements, contact your Allen-Bradley sales representative or distributor.

Specifications

Overview

This chapter lists specifications for a Ethernet TCP/IP system.

Topology:	Bus
Network access method:	CSMA/CD
Primary cable type:	Coax
Maximum cable distance (m):	500 (10base5), 200 (10base2), 100 (10baseT)
Minimum node separation (m):	2.5 (10base5), 0.5 (10base2)
Maximum nodes:	100 (10base5), 30 (10base2), 1 (10baseT)
Data rate:	10M bit/s
Maximum drop cable length (m):	50
Supports redundant cabling:	Yes – 10baseT, fiber MAUs
Maximum repeaters:	2
Maximum application/user connections per PLC-5 processor:	64
Boot-up code needed:	PI – Yes (RAM) PLC-5 – No (built into firmware)
Bridging/routing:	Widely available bridging/routing via hardware and software
Multiple protocols on single wire:	Yes
Station/network management:	Yes via SNMP from Allen-Bradley and others
Maximum data transfer size (16-bit words) per message:	1000
Response time:[1]	5 – 30 msec
Node address type:	IP address
Symbolic data address:	Yes – limited to INTERCHANGE and RSLinx API
Program upload/download:	Yes via 6200, INTERCHANGE, and RSLinx
Online programming available:	Yes
Configuration tasks:	1. PLC-channel configuration 2. Ethernet card 3. TCP/IP software 4. Application software

[1] actual time varies depending on the amount of data transferred and the ladder program

Ethernet PLC-5 Processors

Cat. Nos. 1785-L20E, -L40E, and L80E

	PLC-5/20E	PLC-5/40E	PLC-5/80E
Ethernet port	1	1	1
Remote I/O and DH+ ports	2*	2	2
ASCII port	1	1	1
Coprocessor connection	1	1	1
Memory	16K	48K	100K
I/O points	512	2,048	3,072
Program scan	0.5 – 2 ms/K	0.5 – 2 ms/K	0.5 – 2 ms/K
Vibration testing (operating and non-operating)	10 to 500 Hz, 0.012 in peak to peak 2 g maximum peak acceleration, .012 in peak to peak displacement, sweep rate of 1 octave per minute along mutually perpendicular axes.		
Shock testing	Operating: 15 g peak acceleration for 11±1 ms 3 times along mutually perpendicular axes Non-operating: 30 g peak acceleration for 11±1 ms 3 times along mutually perpendicular axes		
Processor weights	1426 grams, 50.30 ounces	1390 grams, 49.03 ounces	1383 grams, 48.78 ounces

* 1 port is configurable; 1 port is a dedicated DH+ port

Pyramid Integrator Ethernet Interface Module

Cat. No. 5820-EI

Connection	15-pin AUI connector
Weight	5 lbs 3.0 oz.

Ethernet Gateway to Data Highway Plus

5820-GW4, -GW8

These bundled systems include:	4-slot	8-slot
Pyramid Integrator 4-slot chassis	√	
Pyramid Integrator 8-slot chassis		√
Filler plates	√	√
Pyramid Integrator power supply	√	√
Design and installation documentation	√	√
128K Resource Manager Module	√	√
Ethernet Interface Module	√	√
INTERCHANGE software documentation set	√	√

PLC-5 Ethernet Interface Module

Cat. No. 1785-ENET

Backplane Current	2.2A
Heat Dissipation	37.54 BTU/hr
Environmental Conditions	Operating Temperature . . . . . 0 to 60° C (32-140° F) Storage Temperature . . . . . -40 to 85° C (-40 to 185° F) Relative Humidity . . . . . 5 to 95% (without condensation)
Shock	Operating . . . . . 30 g peak acceleration for 11±1 ms duration Non-operating . . . . 50 g peak acceleration for 11±1 ms duration
Vibration (operating and non-operating)	2 g @ 10 to 500 Hz 0.012 inches peak-to-peak displacement
Hardware Addressing	Module communicates through processor channel 3A. It does not communicate across the 1771 I/O backplane.
Communication	Ethernet (TCP/IP protocol, 15-pin AUI transceiver port)
Location	1771-A1B, -A2B, A3B, -A3B1, -A4B chassis, second left-most slot, attached to the processor.
Keying	None
Weight	0.95 kg (2.1 lbs)
Agency Certification (When product or packaging is marked)	• CSA Class I, Division 2, Groups A, B, C, D • UL listed • CE marked for all applicable directives

Control Coprocessor

Cat. Nos. 1771-DMC, 1771-DMC1, 1771-DMC4, and 1771-DXPS Expander Module

Backplane current	Main module	• 2.50 Amps at +5V dc (1771-DMC module with no Ethernet) • 4.00 Amps at +5V dc (1771-DMC1 or -DMC4 module with Ethernet and transceiver)[1]
	Serial expander module	1.25 Amps at +5V dc
Fault relay	Serial expander module	500 mA at 30V ac/dc (resistive)
Environmental Conditions	Operating temperature	0 to 60° C (32 to 140° F)
	Storage temperature	–40 to 85° C (–40 to 185° F)
	Relative humidity	5 – 95% (without condensation)
Communication ports	COMM0	RS-232C; 9-pin
	COMM1, COMM2, and COMM3	RS-232-C, -423, -485, and -422A compatible; 25-pin
	Ethernet	TCP/IP protocol using ftp, telnet, and socket library routines; INTERCHANGE server capability; 15-pin standard AUI
Communication rates	COMM0, COMM1, COMM2, and COMM3	110, 150, 300, 600, 1200, 2400, 4800, and 9600 bit/s, 19.2k bit/s, and 38.4k bit/s
	Ethernet	10M bit/s
Battery life	Main module	1 year

[1] This is an approximate value. See the 1771 Control Coprocessor User Manual, publication 1771-6.5.95, for calculating backplane current requirements.

6200 Series Programming Software

System Requirements

(For PLC-5 Programming Software:
Cat. Nos. Series 9323-PLC5 and 9321-PLC5)

	DOS environment: 9321-PLC5, 9323-PLC5	**Windows environment:** 9321-PLC-5, 9323-PLC5	**Novell environment:** 203-5N5, 6203-5NA
Computer hardware	• 11 Mbytes hard disk space for 6200 software • optional 600 Kbytes for block transfer programming examples • optional 800 Kbytes for Remote Software Support • 5.6 Mbytes for PC/TCP software to program over Ethernet • 547 Kbytes (560,000 bytes) free RAM • recommended additional 384 Kbytes extended or expanded memory to program off line • floppy disk drive (3 1/2") • monochrome or color monitor	• same as DOS environment • 384 Kbytes expanded memory	• same as DOS environment • DOS hard disk requirements apply to file server • DOS RAM requirements apply to each workstation • see Novell documentation for other requirements
Programming terminal	**Minimum** • Allen-Bradley DOS-based • IBM® XT, AT, 80386 or compatible **Recommended** • IBM 80486 or compatible	**Minimum** • IBM 80386SX, 16Mhz or compatible **Recommended** • IBM 80486, 33Mhz or better or compatible	**Recommended** • see Novell documentation for recommendations about file servers and workstations
Operating system	• DOS 3.2, 3.3, 4.x, 5.0, 6.0, or 6.2 • DOS 4.01 (1784-T47)	• same as DOS environment • Windows 3.1	same as DOS environment **Network** • Novell Lite (25 users per file server) • Novell 3.11 (250 users per file server)
Printer interface	• parallel or serial • 80, 132, or 255 columns	same as DOS environment	same as DOS environment
Communication	• 1784-KL series B (DH+) • 1784-KT (DH, DH+, DH II) • 1784-KT2 (DH, DH+, DH II) • 1784-KTK1 (DH+) • 1784-PCMK (DH+) • 6628-A5, -A7 (Ethernet) • 1770-KF2/B (serial to DH+) • 1785–KE (serial to DH+)	• 1784-KL series B (DH+) • 1784-KT (DH+) • 1784-KT2 (DH+) • 1784-PCMK (DH+) • 6628-A5, -A7 (Ethernet)	• same as DOS environment • need one communication card for each workstation that programs online

PLC-5 A.I. Series Programming Software

System Requirements

MS-DOS, Windows v3.1, or Windows 95 operating system.

INTERCHANGE Software

Cat. Nos. 9351-DTLS, -VS, -HPUS, -OFS, -DKTS, -WES, -WKTS, -AIX, -SLRS

Operating System:	Network Interface:	Features:
VAX, OpenVMS, DEC UNIX OFS1, HP-UX, MS-DOS, Windows (KT & Ethernet), Digital UNIX AIX Solaris	Ethernet	• PLC processors on DH+ and Ethernet • read/write of PLC data tables • unsolicited messages from PLC processors • data format conversions • PLC-5 upload/download/compare

RSLinx Software

Cat. Nos. 9355-WAB, -WABOEM, and -WABC

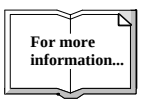
System Requirements

- Microsoft Windows NT, v3.51 or later. Rockwell Software will support Microsoft Windows 95 starting the first quarter of 1997.
- RAM requirements vary depending upon the application
- An Ethernet card and/or an A-B communication device or cable, depending upon the application

RSLinx Communication Options

Programmable Controllers:	Over this network:	Through:
PLC-2 PLC-3 PLC-5/250 enhanced PLC-5	Data Highway	6171-IDH 1771-KC/KD, KE/KF 1770-KF2 Series A or B 1784-KT/KT2 via a 1785-KA
PLC-2 PLC-3 PLC-5/250 enhanced PLC-5	Data Highway II®	1779-KFL/KFLR
PLC-2 PLC-3 PLC-5/250 enhanced PLC-5	Data Highway Plus	6171-IDH 1785-KE 1784-KT/KT2 1770-KF2 Series B
SLC 500™ family	DH-485	1770-KF3 1747-KE
PLC-3	RS-232C w/DF1 protocol	1775-KA modem port
PLC-2		1771-KG
PLC-5/250 enhanced PLC-5 SLC-5/03		directly to processor RS-232 port
PLC–5/20E PLC–5/40E PLC-5/80E PLC-5/250 using an Ethernet Interface module (5820-EI) Ethernet Gateway (8520-GWn)	Ethernet w/TCP/IP	winsock.dll from Microsoft

[1] Enhanced PLC-5 processors include: PLC-5/11, -5/20,-5/20E,-5/30, -5/40, -5/40E, -5/40L, -5/60,-5/60L,-5/80, and -5/80E.



For more information about Rockwell Software and/or Allen-Bradley products, contact a company sales represenative or your local Allen-Bradley distributor.

Notes:

Networking Comparison

Overview

This table compares Data Highway Plus to TCP/IP on an Ethernet network.

	Data Highway Plus	TCP/IP on Ethernet
Topology	Bus	Bus
Network access method	Token-passing	CSMA/CD
Primary cable type	Twinax	Coax, twisted pair
Maximum cable distance (m)	3000	500 (10base5)[1]
Minimum node separation (m)	5	2.5
Maximum nodes & addresses per segment	16 nodes/64 addresses	100 nodes/255 addresses
Data rate (bps)	57.6K	10M
Maximum drop cable length (m)	30	50
Supports redundant cabling	No	Yes – 10baseT, fiber MAUs
Maximum repeaters	N/A	2
Maximum application/user connections per PLC-5 processor	N/A	64
Boot-up code needed	No – built into firmware	PI – Yes (RAM) PLC-5 – No (built into firmware)
Bridging/routing	Bridging via 1785-KA, Static Routing via Pyramid Integrator	Widely available bridging/routing via hardware and software
Multiple protocols on single wire	No	Yes
Station/network management	Yes via Allen-Bradley and PSP partners	Yes via SNMP from Allen-Bradley and others
Maximum data transfer size (16-bit words) per message	~120	1000
Node address type	Octal DH+ only	IP address
Program upload/download	Yes via 6200 and INTERCHANGE	Yes via 6200, AI5, INTERCHANGE, and RSLinx
Online programming available	Yes	Yes
Configuration tasks	1. PLC-DIP switches 2. KT or equivalent 3. Application software	1. PLC-channel configuration 2. Ethernet card 3. TCP/IP software 4. Application software

[1] repeaters and routers can increase this distance

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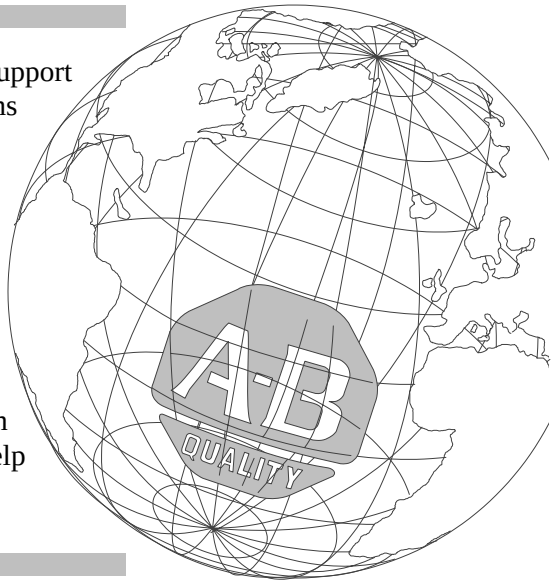

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